Supplemental Meteorological and Oceanographic (METOC) Imager (SMI) Concept

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LONG-TERM GOAL

The long term goal of this project is to define an approach for placing low-cost meteorological sensors on geosynchronous satellites to provide near real-time high resolution visual and infrared meteorological and oceanographic (METOC) imagery to U.S. Navy Ships at sea in the Indian Ocean and South-West Asia forward operating area.

OBJECTIVES

(1) Develop detailed sensor performance specifications including spectral bands, radiometric sensitivity for each band, radiometric accuracy for each band, ground sampling distance in each band, temporal coverage, image registration, data rate, data format, power, weight, size, and environmental requirements based upon specified Naval requirements.

(2) Develop a sensor design that optimally meets the desired performance specifications, identify spacecraft buses and required interfaces, and estimate the life-cycle cost of developing, building and operating multiple Supplemental METOC Imagers (SMIs).

APPROACH

Naval requirements were defined and trade studies were initiated to determine the baseline architecture for the SMI. Alternative approaches were investigated for the scanner, telescope, aft-optics, detector array architecture, and cooler in order to define a baseline, which minimized sensor complexity and cost to achieve the required threshold level of performance based on a qualitative engineering assessment. The baseline architecture was then evaluated using plausible alternatives according to cost and performance figures of merit.

WORK COMPLETED

A Supplemental METOC Imager (SMI) Concept study was completed which contained a design for the SMI fully meeting the requirements, which were defined. Additional design considerations were identified which will require further investigation, candidate spacecraft including commercial Comsats were identified, and life cycle cost estimates were generated.

RESULTS

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Figure (1) provides a view of the proposed concept design for the SMI sensor. The SMI sensor consists of a 30 cm off axis telescope mounted on a two-axis gimbal.

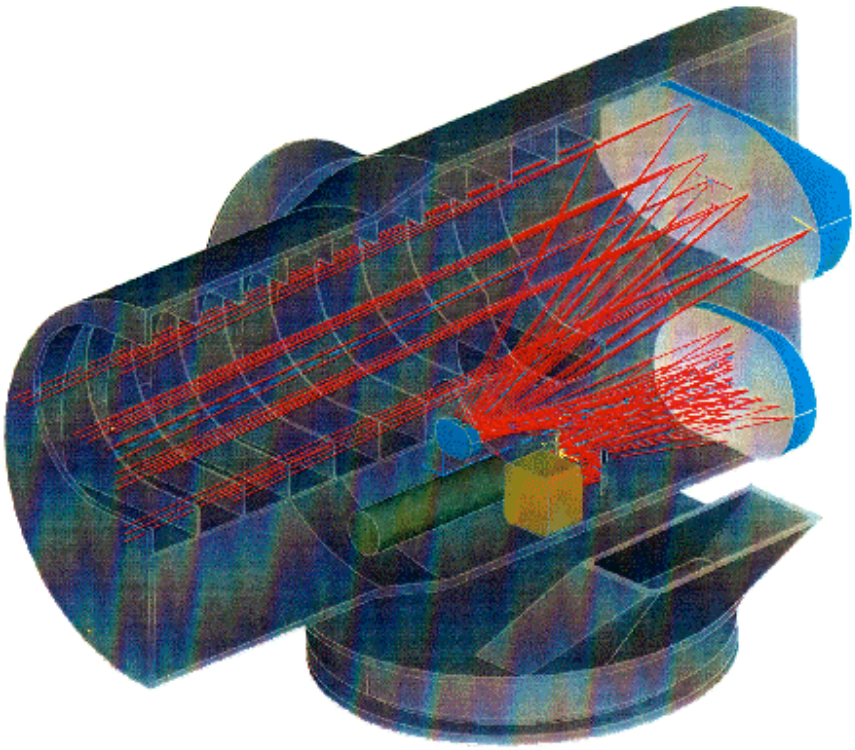

Figure 1. SMI Sensor Concept

This design provides a compact package, which minimizes impact on the spacecraft and mitigates solar intrusion by eliminating the exposed scan mirror and results in no image rotation. It provides good thermal stability and a wide field of view enabling more efficient earth coverage by allowing the use of 2-d focal plane arrays. The dichroic beamsplitter provides simultaneous spatial sampling of the visible and infrared bands. A 1280 x 1280 CCD array is used to provide full disk visual coverage, and a 320 x 240 uncooled array with a filter wheel provides the required IR bands and coverage at a low cost. The performance of these arrays is expected to continue to increase as this technology improves making their use in this design even more cost effective. The SMI design has a projected mass of 82 Kg, a projected volume of 0.5 m^3, and a projected power of 80 W (average) 120 W (peak).

Figure (2) shows the projected coverage for the SMI design. The SMI will provide visible and infrared images showing clouds, storm, water vapor, winds, and surface temperature. It will provide 1 km resolution in the visual band (0.55 to 0.75 um) and 4 km resolution in three infrared bands (97.1 to 7.5 um, 10.2 to 11.2 um, and 13.1 to 13.6 um). Full disk revisit time is 42 minutes, and only 1.3 minutes for a 1500 km x 1500 km specific region of interest. The data rate required for these revisit times

would be about 450 kbps and meet the requirement to be compatible with the existing Navy AN/SMQ-11 system.

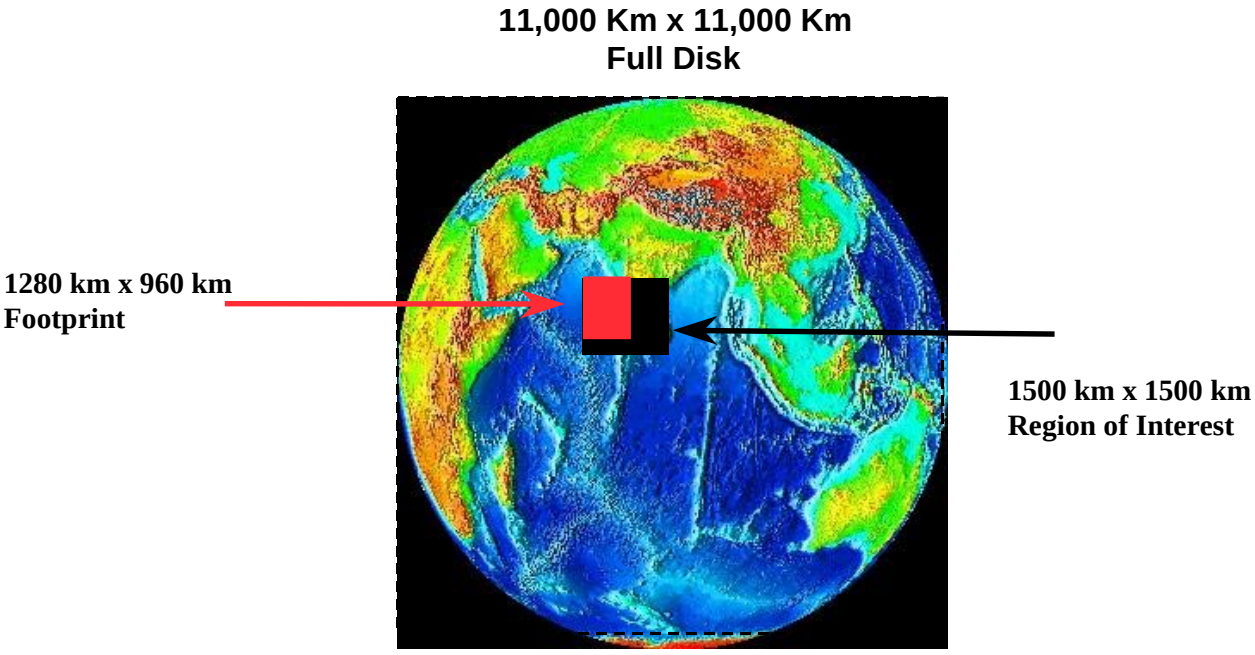

Figure 2. SMI Image Capability

IMPACT/APPLICATION

The results of this study have created a design concept for an imager which could be deployed as an additional payload on a military or commercial geosynchronous communications satellite to provide the Fleet Commander-In-Chiefs with beneficial tactical meteorological and oceanographic information currently not available in a timely or reliable manner.

RELATED PROJECTS

NA

REFERENCES

NA

PUBLICATIONS

NA